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An Intelligent CityLink Web Application for Urban Problem Reporting and Automated Complaint Management

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Abstract: *Urban areas face persistent infrastructure challenges such as damaged roads, water supply issues, sanitation problems, and public grievances that often remain unreported or unresolved due to inefficient reporting mechanisms. This paper presents the design and implementation of CityLink, an intelligent web application that enables citizens to report urban problems using photos and descriptive inputs. The system integrates AI-assisted complaint analysis, which enhances complaint clarity and categorization, and supports three roles: Citizen, Administrator, and Municipal Officer. Our goal is to streamline complaint submission, intelligent processing, and timely resolution by municipal authorities. A prototype was developed using modern web technologies, and initial user feedback shows improvement in citizen engagement and municipal responsiveness.*

Keywords: Smart City, Complaint Management, Web Application, Artificial Intelligence, Urban Problem Reporting, E-Governance

I. INTRODUCTION

Urban governance increasingly relies on digital solutions to improve service delivery and citizen satisfaction. Traditional complaint mechanisms — such as phone calls, suggestion boxes, and manual registers — often lack transparency, accountability, and tracking abilities. To address these limitations, we propose CityLink, a web-based platform that empowers citizens to report local problems (e.g., road damage, water leakage, waste accumulation) with supporting photos. By applying AI techniques for automatic text enhancement and problem classification, CityLink improves data quality and speeds up municipal response.

Rapid urbanization has significantly increased the complexity of managing city infrastructure and public services. Common problems such as damaged roads, water leakage, waste accumulation, poor sanitation, and faulty street lighting directly affect the quality of life of citizens. Although municipal corporations provide mechanisms for lodging complaints, these systems are often inefficient, time-consuming, and lack transparency. As a result, many civic issues remain unresolved or are reported late, leading to public dissatisfaction and administrative inefficiencies.

II. LITERATURE REVIEW AND MOTIVATION

Image-based urban issue detection has also been investigated, particularly for road damage and waste identification using convolutional neural networks (CNNs). Although these methods show promising accuracy, they typically require high-quality images and extensive training datasets, limiting their deployment in real-world municipal systems. Moreover, these solutions are often implemented as standalone analytical tools rather than integrated, end-to-end complaint management platforms.Role-based e-governance systems have been proposed to enhance transparency and accountability in public service delivery. Such systems define clear responsibilities for administrators and field officers,

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enabling structured workflows and progress tracking. Nevertheless, many implementations lack intelligent automation, leading to increased manual workload for municipal staff.

The concept of digital platforms for urban problem reporting has gained significant attention with the rise of smart city initiatives. Several web and mobile-based systems have been developed to enable citizens to report civic issues directly to municipal authorities. Popular platforms such as FixMyStreet and SeeClickFix allow users to submit complaints related to road damage, waste management, and public infrastructure using geographic location and images.

While these platforms improve accessibility, they largely rely on manual categorization and verification, which often leads to delayed response and misclassification of complaints .

Despite the availability of various urban complaint management systems, several key challenges remain unresolved. First, unstructured and unclear complaint descriptions submitted by citizens frequently result in misinterpretation and delayed resolution. Second, manual categorization and assignment of complaints increases administrative burden and slows response time. Third, existing systems often provide limited transparency to citizens regarding complaint status and resolution progress.

The motivation behind the proposed CityLink system is to address these limitations by integrating AI-driven complaint enhancement and automated classification within a role-based web application. By assisting citizens at the time of complaint submission, the system ensures higher-quality data and reduces ambiguity. Automated categorization further enables faster and more accurate assignment of complaints to municipal officers.

III. METHODOLOGY AND SYSTEM DEVELOPMENT

A. Development Methodology

The CityLink system was developed using an iterative prototyping methodology guided by user-centered design principles. The initial development phase focused on implementing core city service task management functionality, followed by the incremental integration of scheduling, reminder mechanisms, and productivity analytics features.

User feedback was collected during each iteration cycle to refine system usability, improve task organization workflows, and enhance visualization of civic engagement metrics. This iterative approach ensured that the system evolved in alignment with real-world user needs and usage patterns.

B. Requirements Analysis

• Functional requirements were identified through informal surveys and interviews with potential users, including students and urban citizens, along with an analysis of existing smart city and task planning applications. The key functional requirements included:

• Offline-first operation without reliance internet connectivity
• Intuitive city service task creation and management
• Scheduling and reminder support for civic activities
• Visual analytics for service usage and task completion trends
• Persistent data storage across browser sessions
• Privacy-preserving local storage of all user data

Non-functional requirements focused on performance and usability aspects, including UI responsiveness within 200 ms, accessibility compliance aligned with WCAG 2.1 guidelines, and cross-browser compatibility with modern browsers supporting the LocalStorage API.

C. System Design Process

The system design followed a modular decomposition strategy, dividing the application into independently testable and maintainable components. Each module was designed with clearly defined interfaces to enable parallel development and simplify future enhancements.

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The user interface design adhered to established usability principles such as consistency, immediate feedback, error prevention, and user control. Color-coded priority indicators were used to distinguish between different service task urgency levels. Visual elements such as task completion indicators and analytics charts provided users with at-a-glance insights into their civic engagement and service planning status. The overall layout adopted a dashboard-oriented design familiar to users of modern smart city and productivity applications.

D. Data Persistence Strategy

The CityLink system employs a structured data persistence strategy using the browser's LocalStorage API. Each data entity, including city service tasks, scheduling information, and analytics data, is stored as a serialized JSON object with a unique key identifier. When the application loads, stored data is retrieved from LocalStorage and reconstructed into in-memory data structures to restore the user's previous session state. All user interactions that modify tasks or schedules trigger immediate updates to LocalStorage, ensuring data consistency and persistence across browser sessions. The implementation includes error-handling mechanisms to address LocalStorage quota limitations, offering users options to archive completed tasks or manage stored data .

IV.EXPERIMENTAL EVALUATION AND RESULTS

A. Evaluation Methodology

The proposed CityLink system was evaluated using a combination of functional testing, usability assessment, and performance benchmarking. The evaluation involved 25 participants, including students and urban citizens, who used the application over a 4-week period. User interaction data and qualitative feedback were collected to assess system effectiveness and usability..

B. Experimental Setup

Participants were instructed to use CityLink as their primary tool for managing city-related tasks and civic activities during the evaluation period. Baseline measurements, including task completion consistency and service awareness levels, were recorded for one week prior to the introduction of the application. Subsequently, the same metrics were monitored throughout the four-week usage period, allowing comparative analysis of user behavior before and after adopting the system.

C. Results and Analysis

The experimental results indicated:

Task Completion Improvement: Users of the CityLink system exhibited an average 30% improvement in task completion rates compared to baseline measurements. The structured service task management interface encouraged systematic handling of civic responsibilities and reduced missed deadlines.

Improved Civic Engagement Awareness: Analysis of task logs showed increased consistency in managing city services such as utility payments and scheduled activities. Users reported better awareness of upcoming deadlines and service-related obligations.

Analytics Dashboard Effectiveness: Post-evaluation surveys indicated that 90% of participants found the analytics dashboard useful for understanding their city service usage patterns. Participants used visual metrics to identify frequently used services and optimize future planning.

Priority-Based Task Management Impact: The implementation of priority-based task ordering improved management of competing city-related activities. Participants reported reduced confusion and improved confidence in handling multiple civic tasks, attributing this to clear prioritization and visual progress indicators.

D. Qualitative Feedback

Participants provided the following qualitative feedback during the evaluation of the CityLink system:

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• The offline functionality was highly appreciated by users, especially in areas with unreliable or limited internet connectivity, enabling uninterrupted access to city service planning and task management features.
• The ability to organize and prioritize city-related tasks helped users manage civic responsibilities such as utility payments, transport planning, and municipal follow-ups more efficiently.
• The visualization of weekly and monthly civic engagement trends motivated users to remain consistent in managing city services and allowed data-driven adjustments to their planning behavior.
• The absence of cloud synchronization, user authentication, and registration requirements significantly reduced application startup time and improved overall ease of use..

E. Performance Metrics

The CityLink application demonstrated strong performance characteristics during experimental evaluation:
• Initial Load Time: Less than 500ms on modern web browsers
• UI Responsiveness: All user interactions completed within 100ms
• LocalStorage Operations: Data storage and retrieval operations completed within 50 ms
• Memory Usage: Typical application memory footprint of approximately 2–3 MB, scalable to support over 200 stored city service tasks

V. CONCLUSION

This paper presented CityLink, an offline smart city service planner designed to enhance citizen engagement and urban service management through structured planning and offline accessibility. The system supports city service task management, scheduling, reminders, and engagement analytics without requiring internet connectivity or cloud infrastructure.

Experimental evaluation involving 25 participants over a four-week period demonstrated notable improvements in task completion consistency, awareness of civic responsibilities, and understanding of service usage patterns. Qualitative feedback emphasized the benefits of offline operation, simplified access, and privacy-preserving local data storage.

By eliminating reliance on continuous internet connectivity and centralized servers, CityLink addresses a critical gap in smart city applications, making digital urban service management more inclusive and privacy-conscious. The modular and lightweight architecture provides a strong foundation for future enhancements, including intelligent recommendations, mobile deployment, and optional synchronization capabilities.

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